Carrier®

# INSTALLATION GUIDELINES

## *Carrier*
## *Liquid-cooled Generators*

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This booklet and the accompanying video are designed to familiarize you with the installation process for Carrier's liquid-cooled residential and commercial generators. Neither this booklet nor the accompanying video replace or supersede any information contained in any of the written documents shipped with your equipment. This booklet should only be used in conjunction with the Owner's Manual, Installation Manual and other technical documents shipped with your equipment.

Future product updates and/or modifications will be reflected in the written documentation included with your equipment. Always read all accompanying documentation carefully before attempting to install any generator, transfer switch or related equipment.

It is essential to comply with all regulations established by the Occupational Safety and Health Administration (OSHA) and strict adherence to all local, state and national codes is mandatory.

Study the SAFETY RULES in the Owner's Manual carefully before installing, operating or servicing any equipment. Use this guide ONLY in conjunction with the Owner's Manual and Installation Manual shipped with the generator. The generator can operate safely, efficiently and reliably only if it is properly installed, operated and maintained.

The manufacturer cannot anticipate every possible circumstance that might involve a hazard. The warnings in this manual, and on tags and decals affixed to the unit are, therefore, not all-inclusive.

Despite the safe design of these generators, operating the equipment imprudently, neglecting its maintenance or being careless can cause possible injury or death.

Permit only responsible and capable persons to install, operate or maintain this equipment.

Potentially lethal voltages are generated by these machines. Ensure all steps are taken to render the machine safe before attempting to work on the generator.

## GENERAL HAZARDS

- For safety reasons, it is recommended that the equipment be installed, serviced and repaired by an Authorized Service Dealer or other competent, qualified electrician or installation technician who is familiar with applicable codes, standards and regulations. The operator must also comply with all such codes, standards and regulations.

- Installation, operation, servicing and repair of this (and related) equipment must always comply with applicable codes, standards, laws and regulations. Adhere strictly to local, state and national electrical and building codes. Comply with regulations the Occupational Safety and Health Administration (OSHA) has established. Also, ensure that the generator is installed, operated and serviced in accordance with the manufacturer's instructions and recommendations. Following installation, do nothing that might render the unit unsafe or in noncompliance with the aforementioned codes, standards, laws and regulations.

- Engine exhaust fumes contain carbon monoxide gas, which can be DEADLY. This dangerous gas, if breathed in sufficient concentrations, can cause unconsciousness or even death. For that reason, adequate ventilation must be provided. Exhaust gases must be piped safely away from any building or enclosure that houses the generator to an area where people, animals, etc., will not be harmed. This exhaust system must be installed properly, in strict compliance with applicable codes and standards.

- Keep hands, feet, clothing, etc., away from drive belts, fans, and other moving or hot parts. Never remove any drive belt or fan guard while the unit is operating.

- Adequate, unobstructed flow of cooling and ventilating air is critical to prevent buildup of explosive gases and to ensure correct generator operation. Do not alter the installation or permit even partial blockage of ventilation provisions, as this can seriously affect safe operation of the generator.

- Keep the area around the generator clean and uncluttered. Remove any materials that could become hazardous.

- When working on this equipment, remain alert at all times. Never work on the equipment when physically or mentally fatigued.

- Never use the generator or any of its parts as a step. Stepping on the unit can stress and break parts, and may result in dangerous operating conditions from leaking exhaust gases, fuel leakage, oil leakage, etc.

## ELECTRICAL HAZARDS

- All generators covered by this guide produce dangerous electrical voltages and can cause fatal electrical shock. Utility power delivers extremely high and dangerous voltages to the transfer switch as well as the standby generator. Avoid contact with bare wires, terminals, connections, etc., on the generator as well as the transfer switch, if applicable. Ensure all appropriate covers, guards and barriers are in place before operating the generator. If work must be done around an operating unit, stand on an insulated, dry surface to reduce shock hazard.
- Do not handle any kind of electrical device while standing in water, while barefoot, or while hands or feet are wet. DANGEROUS ELECTRICAL SHOCK MAY RESULT.
- If people must stand on metal or concrete while installing, operating, servicing, adjusting or repairing this equipment, place insulative mats over a dry wooden platform. Work on the equipment only while standing on such insulative mats.
- The National Electrical Code (NEC), Article 250 requires the frame and external electrically conductive parts of the generator to be connected to an approved earth ground and/or grounding rods. This grounding will help prevent dangerous electrical shock that might be caused by a ground fault condition in the generator set or by static electricity. Never disconnect the ground wire.
- Wire gauge sizes of electrical wiring, cables and cord sets must be adequate to handle the maximum electrical current (ampacity) to which they will be subjected.
- Before installing or servicing this (and related) equipment, make sure that all power voltage supplies are positively turned off at their source. Failure to do so will result in hazardous and possibly fatal electrical shock.
- Connecting these units to an electrical system normally supplied by an electric utility shall be by means of a transfer switch so as to isolate the generator electric system from the electric utility distribution system when the generator is operating. Failure to isolate the two electric system power sources from each other by such means will result in damage to the generator and may also result in injury or death to utility power workers due to backfeed of electrical energy.
- Generators installed with an automatic transfer switch will crank and start automatically when normal (utility) source voltage is removed or is below an acceptable preset level. To prevent such automatic start-up and possible injury to personnel, disable the generator's automatic start circuit (battery cables, etc.) before working on or around the unit. Then, place a "Do Not Operate" tag on the generator control panel and on the transfer switch.
- In case of accident caused by electric shock immediately shut down the source of electrical power. If this is not possible, attempt to free the victim from the live conductor. AVOID DIRECT CONTACT WITH THE VICTIM. Use a non-conducting implement, such as a dry rope or board, to free the victim from the live conductor. If the victim is unconscious, apply first aid and get immediate medical help.

- Never wear jewelry when working on this equipment. Jewelry can conduct electricity resulting in electric shock, or may get caught in moving components causing injury.

## FIRE HAZARDS

- Keep a fire extinguisher near the generator at all times. Do NOT use any carbon tetra-chloride type extinguisher. Its fumes are toxic, and the liquid can deteriorate wiring insulation. Keep the extinguisher properly charged and be familiar with its use. If there are any questions pertaining to fire extinguishers, consult the local fire department.

## EXPLOSION HAZARDS

- Do not smoke around the generator. Wipe up any fuel or oil spills immediately. Ensure that no combustible materials are left in the generator compartment, or on or near the generator, as FIRE or EXPLOSION may result. Keep the area surrounding the generator clean and free from debris.
- Generator sets may operate using one of several types of fuels. All fuel types are potentially FLAMMABLE and/or EXPLOSIVE and should be handled with care. Comply with all laws regulating the storage and handling of fuels. Inspect the unit's fuel system frequently and correct any leaks immediately. Fuel supply lines must be properly installed, purged and leak tested according to applicable fuel-gas codes before placing this equipment into service.
- Gaseous fuels such as natural gas and liquid propane (LP) gas are extremely EXPLOSIVE. Natural gas is lighter than air, and LP gas is heavier than air; install leak detectors accordingly.

## GENERATOR INSTALLATION

These generators are liquid-cooled, engine-driven generator sets designed to supply electrical power that operates critical electrical loads during utility power failure. The generators are factory- installed in a weather resistant, all metal enclosure and are intended for outdoor installation only.

## BEFORE INSTALLATION

Before installing this equipment, check the ratings of both the generator and the transfer switch. Read "Emergency Isolation Method" and "Total Circuit Isolation Method" in Section 3 of the Installation Manual. The generator's rated wattage/ amperage capacity must be adequate to handle all electrical loads that the unit will power. The critical (essential) loads may need to be grouped together and wired into a separate "emergency" distribution panel.

If an open bottom is used, the engine-generator is to be installed over non-combustible materials and should be located such that combustible materials are not capable of accumulating under the generator set.

Only qualified, competent installation contractors or electricians thoroughly familiar with applicable codes, standards and regulations should install these standby electric power systems. Installers must comply strictly with all codes, standards and regulations pertaining to the installation.

After the system has been installed, do nothing that might render the installation in non-compliance with such codes, standards and regulation

## NFPA STANDARDS

The following published standards booklets pertaining to standby electric systems are available from the National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269:

- NFPA No. 37, STATIONARY COMBUSTION ENGINES AND GAS TURBINES
- NFPA No. 54, NATIONAL FUEL GAS CODE
- NFPA No. 58, LIQUIFIED PETROLEUM GAS CODE
- NFPA 70, NATIONAL ELECTRIC CODE (NEC)
- NFPA 99, STANDARD FOR HEALTH CARE FACILITIES
- NFPA 101, LIFE SAFETY CODE
- NFPA 110, STANDARD FOR EMERGENCY AND STANDBY POWER SYSTEMS
- NFPA 220, STANDARD TYPES OF BUILDING CONSTRUCTION

NOTE:
It is essential to use the latest version of any standard to ensure that the generator and its accessories comply with all the applicable standards and local codes.

## OTHER PUBLISHED STANDARDS

In addition to NFPA standards, the following information pertaining to the installation and use of standby electric systems is available:

- Article X, NATIONAL BUILDING CODE, available from the American Insurance Association, 85 John Street, New York, N.Y. 10038.

- AGRICULTURAL WIRING HANDBOOK, obtainable from the Food and Energy Council, 909 University Avenue, Columbia, MO, 65201.

- ASAE EP-364.2, INSTALLATION AND MAINTENANCE OF FARM STANDBY ELECTRIC POWER, available from the American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, MI 49085.

- A52.1, AMERICAN NATIONAL STANDARD FOR CHIMNEYS, FIREPLACES AND VENTING SYSTEMS, available from the American National Standard Institute, 1430 Broadway, New York, NY 10018.

The installer must comply with all applicable state and local codes.

## GROUNDING THE GENERATOR

A grounding lug is provided on the generator mounting base for the purpose of grounding the frame and the external electrically conductive parts of this equipment to an approved earth ground and/or grounding rods where required by the National Electrical Code (Figure 1.6). Grounding procedures must meet local regulations.

## BATTERY INSTALLATION

Standby generators installed with automatic transfer switches will crank and start automatically when NORMAL (UTILITY) source voltage is removed or is below an acceptable preset level. To prevent such automatic start-up and possible injury to personnel, do not connect battery cables until certain that normal source voltage at the transfer switch is correct and the system is ready to be placed into operation.

Storage batteries give off explosive hydrogen gas. This gas can form an explosive mixture around the battery for several hours after charging. The slightest spark can ignite the gas and cause an explosion. Such an explosion can shatter the battery and cause blindness or other injury. Any area that houses a storage battery must be properly ventilated. Do not allow smoking, open flame, sparks or any spark producing tools or equipment near the battery.

Battery electrolyte fluid is an extremely caustic sulfuric acid solution that can cause severe burns. Do not permit fluid to contact eyes, skin, clothing, painted surfaces, etc. Wear protective goggles, protective clothing and gloves when handling a battery. If fluid is spilled, flush the affected area immediately with clear water.

Do not dispose of the battery in a fire. The battery is capable of exploding.

Do not open or mutilate the battery. Released electrolyte can be toxic and harmful to the skin and eyes.

The battery represents a risk of high short circuit current. When working on the battery, always remove watches, rings or other metal objects, and only use tools that have insulated handles.

## VENTED BATTERIES

The electrolyte is a diluted sulfuric acid that is harmful to the skin and eyes. It is electrically conductive and corrosive. The following procedures are to be observed:

- Wear full eye protection and protective clothing.
- If electrolyte contacts the skin, wash it off immediately with water.
- If electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention.
- Spilled electrolyte is to be washed down with an acid-neutralizing agent. A common practice is to use a solution of one pound (500 grams) bicarbonate of soda to one gallon (4 liters) of water. The bicarbonate of soda solution is to be added until the evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water and the area dried.

Lead acid batteries present a risk of fire because they generate hydrogen gas. The following procedures are to be followed:

- DO NOT SMOKE when near batteries.
- DO NOT cause flame or spark in battery area.
- Discharge static electricity from your body before touching batteries by first touching a grounded metal surface.

Servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

For recommended batteries, see the “Specifications” section in the Owner’s Manual. All batteries must be at 100 percent state of charge before they are installed on the generator.

When using maintenance-free batteries, it is not necessary to check the specific gravity or electrolyte level. Have these procedures performed at the intervals specified in the “Maintenance” section in the Owner’s Manual. A negative ground system is used. Battery connections are shown on the wiring diagrams. Make sure all batteries are correctly connected and terminals are tight. Observe battery polarity when connecting batteries to the generator set.

NOTE:

Damage will result if the battery connections are made in reverse.

**BEFORE YOU BEGIN**

Contact the local inspector or City Hall to make sure you are aware of all federal, state and local codes that could impact the installation. Secure all required permits before starting the job.

## MOUNTING PAD

The mounting pad should be located as close as possible to the transfer switch and fuel supply. Make sure you leave adequate room around the generator for service access. Five feet is a good rule of thumb, but local codes vary.

Place the pad high enough to keep rising water from reaching the generator. Make sure the generator will have adequate and unobstructed airflow by choosing an open space free of trees, shrubs, buildings or other obstructions.

The unit must be positioned so air vents won't become clogged with leaves, grass, snow or debris. Make sure that exhaust fumes will not enter the building through eaves, windows, ventilation fans or other air intakes.

Position the electrical conduit for power wiring, control wiring and the battery charger circuit so the generator can be placed correctly on the pad.

The concrete pad should be reinforced and deep enough so that the weight of the pad is equal to the weight of the generator (see Installation Manual).

The length and width of the pad should exceed the length and width of the generator by at least 12 inches on all sides and the pad must be level within ½ inch all around.

## GENERATOR PLACEMENT

Use a forklift, boom truck or similar equipment with sufficient capacity to move the generator to the mounting pad area. The operator should be certified and experienced in generator installation.

Before placing the generator on the pad, inspect for shipping damage and if necessary, file a claim with the shipper.

After removing the bolts holding the generator base frame to the wooden pallet, use the lifting eyes on the base frame to lift the generator onto the pad.

When properly positioned, secure the base frame to the pad with appropriately sized masonry bolts.

Connect an approved ground strap to the grounding lug on the base frame and to an earth ground or grounding rod consistent with local regulations.

## CONNECTING THE FUEL SYSTEM

Gaseous fuel systems should be installed by a licensed plumber who is experienced in generator installation and is familiar with local codes and regulations.

When installing rigid natural gas lines, always use AGA approved black pipe.

In most applications, a manual shutoff valve and a primary regulator must be a part of the installation.

A section of UL or AGA approved flexible fuel line is required to protect the rigid fuel line connections against vibration from the generator.

Installing the flexible fuel line with as few bends as possible will allow the flexible section to absorb and mitigate vibration. Never use a flexible fuel line to avoid an elbow in a rigid line and never attach gaseous fuel line supports to any part of the generator. Doing so defeats the purpose of the flexible fuel line.

After checking all connections for leaks, check the static gas pressure at the secondary regulator to ensure there is sufficient pressure to operate the generator. (See Owner's Manual)

If the static pressure is too low, or is higher than 14 inches of water column, notify the local gas supplier.

## AUTOMATIC TRANSFER SWITCH INSTALLATION

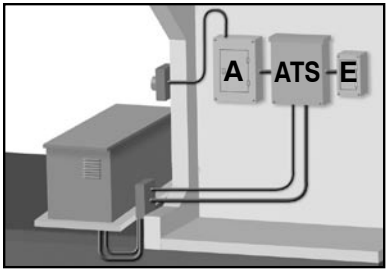

Always inspect the transfer switch for shipping damage. Never mount a switch that shows any evidence of damage.

Locate the transfer switch as close as possible to the main service and load distribution panel. Make sure the switch is not located where water or corrosive substances could drip onto the enclosure.

It's important to protect the transfer switch against impact, construction grit and metal fragments at all times.

The transfer switch must be mounted vertically and must be level and plumb.

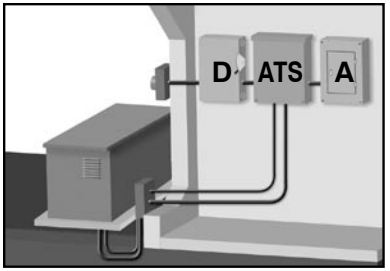
Generac RTS and HTS switches are open transition switches. Because load circuits can only be connected to one power supply at a time, open transition switches prevent electrical feedback between utility circuits and generator circuits.




**Standby Circuit Isolation**

The generator powers only designated loads that are grouped together and wired into a separate emergency distribution panel. The transfer switch is installed between the main distribution panel (A) and the emergency distribution panel (E).

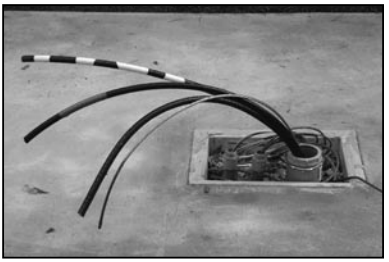
The amperage rating of the transfer switch must be equal to, or greater than, the highest amperage rating of the utility and generator breakers feeding the switch.




**Total Isolation**

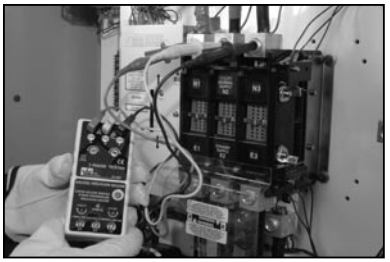
The generator will be backing up all electrical loads within the circuit, so the amperage rating of the transfer switch must be equal to, or greater than, the amperage rating of the normal utility service.

Unless a service entrance rated transfer switch is used, a main service disconnect (D) must be located before the transfer switch. The transfer switch is installed between the utility service entrance and the building distribution panel (A).



Regardless of configuration, power wiring, control wiring and wiring for the 15 or 20 Amp circuit required for the 2-Amp battery charger must always be in separate conduit.

In all installations, a ground wire will run through the power conduit from the generator control panel to the transfer switch.



In any three-phase application, the phase rotation of the generator power lines must match the phase rotation of the utility power lines at the transfer switch.

While supporting the lugs, use a torque wrench to tighten the lugs on the generator circuit breaker and the transfer switch. Torque specifications are in the Owner's Manual.

Consult the Technical Manual that comes with the transfer switch for wiring diagrams and any product changes, modifications or updates.

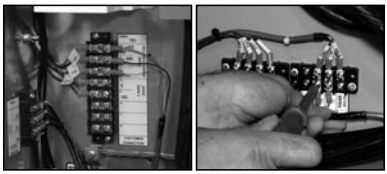
**HTS Transfer Switches**

HTS switches are used on generators equipped with the PowerManager® H-100 Controller.

Power wiring lugs are clearly marked in the transfer switch. ·

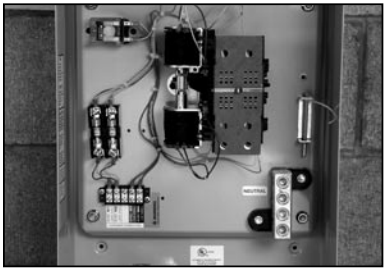
N = Normal Utility Supply·
E = Generator Connection Panel·
T = Load Distribution Panel

Neutral wires from the utility, the load source and the generator are all connected to the same lug in the switch.



The control wires consist of RS485 positive and RS485 negative communication wires run in a shielded cable. The RS485 wiring must consist of a 2-wire twisted pair cable with overall screen.

The shield wire of the RS485 communication cable must only be connected at the generator. The shield wire should be taped out of the way in the transfer switch.



**RTS Transfer Switches**

Generators equipped with the R-100 Digital Controller will be matched to an RTS transfer switch.

The wiring configuration is different from an HTS switch, but the power lugs use the same coding.

N = Normal Utility Supply
E = Generator Connection Panel
T = Load Distribution Panel

When installing an RTS switch, terminals 178 and 183 are not used.

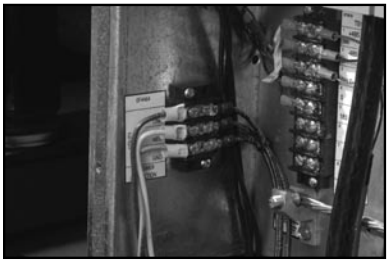
## BATTERY INSTALLATION

Before connecting the battery, make certain that normal utility voltage at the transfer switch is correct and the system is ready to be put into operation.

Check the engine oil, the coolant level, belt tension, and if so equipped, the gearbox oil.

Check the battery to make sure it is fully charged before installing.

Follow all safety procedures detailed in the Owner's Manual. Always connect the nega and observe polarity when connecting the battery. Make sure all terminal connections are tight.



Connect the power leads for the battery charger to the 120-Volt, 15 or 20-Amp circuit as shown in the Installation Manual.


You'll need to check the control panel to make sure the H-100 controller is properly configured for the HTS transfer switch. Using the control panel is simple once you understand the process.

If the main menu screen is not showing on the right screen display, press the MENU button.

## GENERAL INSTRUCTIONS


The main menu display lists the eight sections shown here. There are several adjustments you will need to make during installation, but they are all done in two sections — Status and Exercise/HTS.


Each of these two sections has multiple pages. When you select one of the sections, you will see "More ← →" and (numbers) in parentheses.

"More" means there are more pages and the arrows can be selected to go back (←) or go forward (→).

The numbers in parentheses indicate which page you are on and the total number of pages in the section. (1 - 4) indicates you are on page (1 - 4) pages.

## NAVIGATION TIPS


Use the ARROW keys to move the cursor up, down, left or right.

When the cursor is flashing, it can be moved to another line or location on the screen, but no settings can be changed.

In order to change a setting, you will always have to press ENTER. When you press enter, the flashing cursor will become a static underline.

In order to save a setting, you must always press ENTER again.

## CONFIGURING THE H-100 FOR THE HTS TRANSFER SWITCH

If the main menu page is not displayed on the panel's right screen, press MENU.

Use the arrow keys to move the flashing cursor to "Exercise/HTS" and press ENTER.


A new screen should appear indicating you are on page (1 - 4).


Press ENTER three more times until the screen displays page (4 – 4). If the display shows "HTS #1 Disabled" use the UP or DOWN arrow keys to move the flashing cursor to Disabled.


Press ENTER. When the cursor becomes a static underline, press either the UP OR DOWN arrow key once and the screen should show “HTS #1 Enabled”.

Press ENTER to save the setting.


To confirm that the controller is communicating properly with the HTS transfer switch, use the ARROW keys to scroll to the bottom of the screen and select the “go back” arrow (←).

Press ENTER. If the top line of the display shows “HTS #1 Enabled”, the controller is properly configured and you can return to the main menu display by pressing MENU.

If the display shows “HTS #1 Disabled”, go back to page (4 - 4) to enable the switch, then check again.

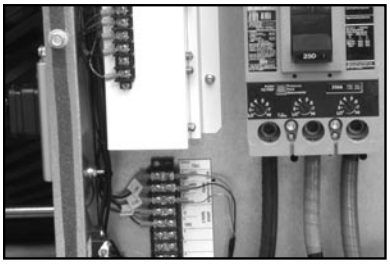
## OPERATIONAL CHECKS

Make sure all breakers in the main distribution panel are open so that loads cannot be accidentally transferred to the generator until you are ready to do so.


To conduct the necessary operational checks you will have to work inside a live transfer switch. Refer to NFPA 70E for the required safety equipment.

With utility power present and the generator in the OFF position, select AUTO in the transfer switch.

Verify that utility voltage and frequency are correct in the transfer switch. In 3-phase applications, you will also need to verify phase rotation.



If phase rotation is incorrect, switch the A and C connections in the generator connection box and check phase rotation again. Refer to the Installation Manual for correct procedures.


With utility power present and the generator OFF, select MANUAL in the transfer switch and open the main breaker.


Select MANUAL on the generator control panel to start the generator with no loads present.

If the Low Gas Pressure alarm goes off or the Low Fuel Pressure indicator shows on the control panel display, contact the plumber who installed the gas lines.


To check automatic operation, shut off the generator; then turn the key to AUTO and close the main breaker.


Place the transfer switch in AUTO and open the main breaker. The generator should start and after the appropriate time delay, the transfer switch should transfer power to the generator without any loads.

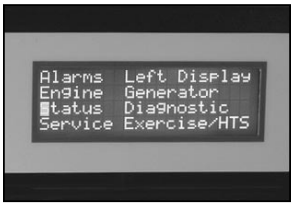
Close the individual breakers in the distribution panel one at a time until the generator has accepted the entire load.

Then close the main utility breaker to restore normal utility power.

After the engine has completed its cool-down cycle and has shut off, open the main breaker and allow the generator to accept the entire load immediately. Verify gas pressure at the secondary regulator while the unit is under full load.


After shutting off the generator and restoring utility power, you'll need to set the current time and date and schedule the automatic exercise function in the generator control panel.

## SETTING THE TIME & DATE



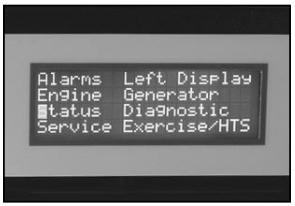

From the main menu, use the DOWN arrow key to move the flashing cursor to “Status” and press ENTER to go to page (1- 2).


Use the ARROW keys to move the flashing cursor to the beginning of the time / date line and press ENTER.

Use the ARROW keys to set the correct hour. Note: The controller uses a 24 hour clock. (i.e., 11:00 PM is 23:00). Press ENTER to save the hour setting, then use the right arrow key to scroll over and set the minutes.

Press ENTER to save the minute setting, then scroll right and set the current date. (The day of the week will change automatically when you change the date.)

Press ENTER to save the date before leaving the screen.



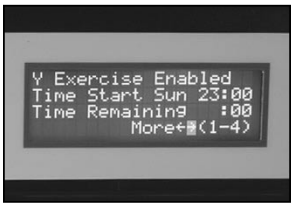

Press MENU to return to the main menu display.

## ENABLING & SCHEDULING THE WEEKLY EXERCISE FUNCTION


From the main menu , select “Exercise/HTS” and press ENTER once to go to page 1 of the section.


If the top line of the display shows “Y Exercise Enabled”, the setting is correct.

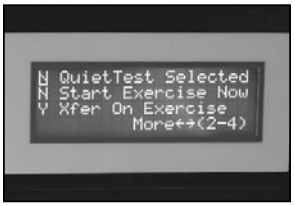
If the top line of the display shows “N Exercise Enabled”, you will have to enable the exercise function. Use the UP or DOWN arrow key to move the flashing cursor to the “N” on the first line and press ENTER.




Press the UP or DOWN arrow key to change the “N” to “Y” and press ENTER to save the setting. To schedule the weekly exercise function, press the down arrow key once to scroll to the “Time Start” line.

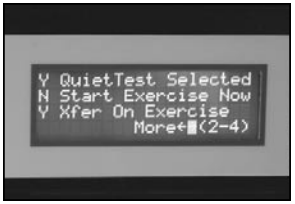
Use the arrow keys to set the day of the week and time the customer wants the unit to exercise. Remember to press ENTER to select the field you want to change and again to save each change.

## ENABLING THE QUIET-TEST FEATURE




To enable Quiet-Test, scroll to the page information at the bottom of the screen, select the forward arrow (→) to go to page (2 - 4) and press ENTER.

If the top line of the display shows “N Quiet Test Selected”, you will have to enable the Quiet-Test feature. Move the cursor to the “N” and press ENTER.




Use either the UP or DOWN arrow key to change the “N” to “Y” and press ENTER to save the setting.

When finished, press MENU to return to the main menu display.


Finally, make sure that both the generator and the transfer switch are in the AUTO position before leaving the job site.

Every installation has its own unique set of circumstances and requirements. This booklet provides guidelines for basic installations only and is not intended to cover all applications. If you have any questions or concerns after carefully reading all documentation received with the equipment, contact your nearest CARRIER DEALER for assistance.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